DOCUMENT RESUME

ED 415 099 SE 061 026

AUTHOR White, Jennifer Meux; Hosoume, Kimi
TITLE Enhancing Science and Mathematics Education for Child Care Providers and Preschool Teachers.
INSTITUTION California Univ., Berkeley. Lawrence Hall of Science.
SPONS AGENCY Fund for the Improvement of Postsecondary Education (ED), Washington, DC.
PUB DATE 1993-00-00
NOTE 51p.
CONTRACT P116B90160
PUB TYPE Reports - Descriptive (141)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *College Curriculum; Community Colleges; *Educational Change; Educational Innovation; Educational Strategies; Elementary Education; *Knowledge Base for Teaching; *Mathematics Curriculum; Postsecondary Education; Preschool Education; Preschool Teachers; *Science Curriculum

ABSTRACT

The Lawrence Hall of Science (LHS), University of California at Berkeley has completed a 3-year project to develop a science and mathematics education course and science curriculum for early childhood educators. This project was in response to the need for improving the science and mathematics knowledge and teaching skills of adults who work with young children. The project conducted three 18-hour community college courses for 98 teachers. Eight Saturday workshops reached another 245 preschool educators. As support for the course activities, four teacher's guides and a handbook on early childhood teaching strategies were developed. The four teacher's guides have been translated into Spanish. The project materials were disseminated through 13 conference workshops for over 800 early childhood educators. The project courses, workshops, and teacher's guides were highly received by the 1,143 project participants and continue to be offered through LHS and local colleges. This project report provides an overview of the project, a section tracing the project from problem definition to project conclusion, information on the background and origins of the project organized into phases, a full description of the project and its courses, and an evaluation and project results. (DDR)

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COVER SHEET

ED 415 099

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Sponsored Projects
University of California at Berkeley
Berkeley, CA 94720

Grant #: P116-B90160

Starting Date: September 1, 1989
Ending Date: August 31, 1992
Number of Months: 36

Jennifer Meux White, Project Director, (510) 642- 1057
Kimi Hosoume, Project Coordinator, (510) 642-9633
Lawrence Hall of Science
University of California at Berkeley
Berkeley, CA 94720

FIPSE Program Officer: Brian Lekander

Grant Award:

Year 1	$77,002
Year 2	$72,864
Year 3	$64,200
TOTAL	$214,066

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Enhancing Science and Mathematics Education for Child Care Providers
and Preschool Teachers
FIPSE Grant No:P116-B90160

Summary of the Project

The Lawrence Hall of Science (LHS), University of California at Berkeley has completed a 3-year FIPSE project to develop a science and mathematics education course and science curriculum for early childhood educators. This project was in response to the need for improving the science and mathematics knowledge and teaching skills of adults who work with young children. The project conducted three 18-hour community college courses for 98 teachers. Eight Saturday workshops reached another 245 preschool educators. As support for the course activities, four teacher's guides and a handbook on early childhood teaching strategies were developed. The four teacher's guides have been translated into Spanish. The project materials were disseminated through 13 conference workshops for over 800 early childhood educators. The project courses, workshops, and teacher's guides were highly received by the 1,143 project participants and continue to be offered through LHS and local colleges.

Jennifer Meux White, Project Director
Kimi Hosoume, Project Coordinator
Lawrence Hall of Science
University of California at Berkeley
Berkeley, CA 94720
(510) 642- 1057
(510) 642-9633

Titles of Teacher's Guides and Handbook:
Tree Homes
Homes on the Ground
Ant Homes Under the Ground
Homes in a Pond
Preschool Science and Math Explorations: The PEACHES Handbook for Educators
Los Hogares en los Arboles
Hogares en el Suelo
Hogares Subterráneos
Los Hogares en un Estanque

EXECUTIVE SUMMARY

Enhancing Science and Mathematics Education for Child Care Providers and Preschool Teachers
Lawrence Hall of Science, University of California at Berkeley, Berkeley, CA 94720
Jennifer White, Proj. Dir., (510)642-1057 - Kimi Hosoume, Proj. Coord., (510)642-9633

A. Project Overview: The Lawrence Hall of Science (LHS), University of California at Berkeley has completed a 3-year FIPSE project to develop a science and mathematics education course and science curriculum for preschool teachers and child care providers. The Project is called PEACHES-Preschool Explorations for Adults, Children, and Educators in Science. The PEACHES Project was in response to the need for improving the science and mathematics knowledge and teaching skills of adults who work with young children. The project conducted three 18-hour community college courses for 98 teachers. Eight Saturday workshops reached another 245 preschool educators. As support for the course activities, four teacher's guides and a handbook on early childhood teaching strategies were developed. The four teacher's guides have been translated into Spanish. The project materials were disseminated through 13 conference workshops for over 800 early childhood educators. The project courses, workshops, and teacher's guides were highly received by the 1,143 project participants and continue to be offered through LHS and local colleges.

B. Purpose and Need: Educators throughout the U.S. recognize the shortage of trained instructors, at all grade levels, who are confident and competent to teach science and mathematics (Begley and Cohn, 1988). The lack of knowledge about science and mathematics education is even more pronounced in early childhood educators, since these subjects have not been part of most traditional preschool curricula (Richard, 1973; Bennett, 1978; Hays, 1984).

Science activities offer interesting materials and topics that motivate both the teacher and the child to investigate the world around them. Furthermore, such early explorations promote interest in science which can remain with the child throughout life (Smith and Johnson, 1981). Participation in science activities that build children's visual-spatial and problem-solving skills will prepare preschoolers for their role in the twenty-first century as informed and productive citizens.

C. Background and Origins: The commitment of LHS to provide science education for the young child and the preschool educator is strong as evidenced by the many ongoing programs for individuals, preschools, and child care centers; however, the program has been limited to those who have the time, transportation and money to participate. By taking tuition-free science activities and training to community child care centers and early childhood conferences, the Project demonstrated an effective approach to teaching science for child care providers that can be adopted by science centers and colleges. Early childhood educators from local community colleges continue to use project materials in their child development courses.

D. Project Descriptions

Recruitment and Participant Selection: We made use of several established networks in the preschool community. Informational flyers were included in mailings and newsletters to preschools, child care centers, and individuals through early childhood agencies and programs. Emphasis was placed on seeking low-income and minority adults from urban communities. Project incentives included a tuition-free one-unit course, classroom materials, five teacher's guides and handbook, college credit, and opportunities to share curriculum and experiences. The course participants came from a diversity of school settings: family home day care, private preschools, school district preschools, university and college centers, and government-funded preschools, including Head Start programs. Ninety-four percent of the teachers taught in urban settings and worked with ethnic-minority preschoolers and children at-risk. Sixty percent of the teachers are of an ethnic-minority and represent 10 East Bay cities including Oakland, Berkeley, Richmond, Alameda, and Pittsburg. Ten percent of the participants are Spanish-speaking and work with Spanish-bilingual children.

The College Courses: During each of the three years of the project, a science content and methods course was presented to thirty-two child care providers, preschool and elementary school teachers, assistants, and parents working in cooperative child care sites from the San Francisco Bay Area. The biological and physical science content of the course was taught through a combination of activity-based lessons in the form of simulations, games, and investigations that provided the foundation for basic understandings of living things and objects, and their relationships to the environment. Methods and philosophy regarding how to effectively present hands-on activities to children were included in the course through demonstrations, activities, and discussions.

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The Teacher's Guides and Handbook: At the end of each course session, participants were provided with a trial version of one of the four *Animal Homes* Teacher's Guides titled *Tree Homes, Homes on the Ground, Ant Homes Under the Ground,* and *Pond Homes*. The guides reinforce the science process, content, and methods from the course by providing activities that use this approach with youngsters. Strategies for how to identify, reinforce, and extend science concepts to young children were included in a Handbook to assist teachers in using the science units. Feedback from the courses, workshops, and written evaluations were incorporated into each guide to produce a trial I and trial II version of the guides and handbook.

The Saturday Workshops: Three PEACHES units were presented in Years One and Two in eight Saturday classes. These classes were presented to 245 educators unable to attend the multi-week courses. The workshops were conducted at public child care centers and preschools that serve urban and minority populations. Later, teachers provided written evaluations of the activities they used with children. This feedback was used to modify the activities prior to revising the teacher's guides in English and Spanish.

Conference Workshops and Dissemination: In Year Three, project staff disseminated the model course and materials throughout California and the nation by conducting workshops at 13 conferences for 800 early childhood educators, science educators, college professional development staff, and science center education coordinators. The project staff attended the national and regional annual conferences of Head Start in San Diego and Sacramento, California, and other state conferences. Multiple workshops were presented at each conference with 30 to 125 teachers attending. There was tremendous enthusiasm for the training and teacher's guides as was evident by the large enrollments and positive feedback submitted to the project. Information on PEACHES workshops, courses, and guides has been disseminated to more than 24,000 people who have received special mailings and newsletters.

E. Project Results

Pre-Course Survey: Selected teachers were given a survey to complete prior to the beginning of the course. Participants were asked to indicate the frequency of teaching science to preschoolers, their confidence in teaching science, background in science and their goals in preschool education. The following table shows the response of course participants to key questions from the survey.

		Yr. 1	Yr. 2	Yr. 3
1.	Taught science 1-2 times per month or less:	71%	70%	39%
2.	Felt somewhat or not at all comfortable teaching science to children	45%	40%	29%
3.	Most recent contact with science in high school	44%	44%	63%
4.	Number of years working with preschoolers	10.6	10.9	4.1 years per teacher
5.	Completed High School with some college	41%	27%	75%
6.	Completed A.A. Degree or other degree	59%	66%	25%

Evaluation: The Project administered evaluation questionnaires, interviews, and surveys to course and workshop participants. These sources of information were used to evaluate the program in the following areas:

1. Formative feedback on course and curriculum (through comment cards, evaluation of specific activities, and final course evaluations);
2. Teachers' uses of materials and techniques, (through feedback on uses of activities in classes, final course evaluations, and follow-up surveys);.
3. Impact on teacher knowledge, attitudes and instruction, (through surveys, comment cards, final evaluations, follow-up surveys, and interviews); and
4. Impact on children's knowledge and attitudes, (through case studies in Year Two, and teacher assessments on final evaluations).

The participants responded very favorably to the science activities, small group discussions, and homework assignments. The course included additional time for small group discussion and planning. Teachers also shared the other science and math activities that they conduct in their classes. These sharing sessions led to long lasting collaborations among teachers from different schools. Teachers received an evaluation for each of the four activity guides. The evaluation asked for written comments on the successes and problem areas of each activity after presenting it to children. The evaluation also asked for the amount of time to prepare for the activity, the overall appropriateness of the activities, and modifications suggested for the revision. Participants were required to complete two evaluations for course credit.

Final Course and Curriculum Evaluation: Teachers' ratings of the course and curriculum materials are overwhelmingly positive. Ratings on all aspects of the course average 4.5 to 5.0 (out of 5.0) for all three groups. In the final course evaluation, 78% of the teachers reported teaching more science--with most reporting a frequency of 2-3 times per week. Many noted that they were incorporating science into other areas of the curriculum, "throughout the day." Teachers' self reports indicated that nearly all felt a direct positive impact on their level of confidence in teaching science (90%) and on their teaching techniques (67%). They reported that they were more comfortable using science activities in the classroom and had an expanded concept of what science really is and how to get that across to children. Teachers said they added more "drama," more hands-on activities, more questioning techniques to their instruction, and were much more enthusiastic about teaching science. Nearly all teachers reported positive changes in their attitudes toward animals, using the out-of-doors, their confidence in teaching with animals, and their instructional approach in integrating science into other areas of the curriculum.
Impact on Children's Knowledge and Attitudes: With each course participant teaching an average of 15 children, at least 1470 children of course participants have experienced science activities through PEACHES. Three-fourths of the teachers described positive, specific changes in children's behavior, usually in the form of greater interest and greater respect or caring for nature, animals, and the environment. Some teachers also noted improvements in children's vocabulary and levels of questions asked, as well as good retention of concepts introduced in the activities.
1992 Follow-up evaluation: Follow-up surveys and interviews were conducted with 39 FIPSE PEACHES alumni. One to two years following their training, 96% of these participants reported that they were still using PEACHES materials and methods in their classrooms, usually three to five times per week. The 39 alumni who participated in the follow-up studies and interviews reported that, since their training, they have taught PEACHES to a total of 1,020 children, for an average of 26 children per participant. Participants also reported many positive changes in their own and their children's attitudes toward science in the classroom. Children have become increasingly skilled at paying attention and answering and asking questions intelligently, and have shown a marked increase in curiosity and enthusiasm about science activities. In addition teachers report that their children are more aware of their environment and more caring toward living things in that environment. 100% of the teachers claimed that their confidence in teaching science and math to preschoolers has continued to increase since they took the course. Finally, 95% of the teachers surveyed reported that they continue to teach more science as a result of their PEACHES training, and that they still use all four of the PEACHES units regularly and enthusiastically.
Institutionalization and Continuation: The course and instructional materials have been institutionalized within the LHS educational program and local colleges. School districts continue to arrange LHS teacher workshops on a fee basis that feature the PEACHES curriculum. Each quarter, a PEACHES course for teachers and parents on a variety of topics is held at LHS. The Project has developed a regional network of early childhood educators interested in promoting preschool science, and continues to use the project materials in its informal education programs for families and parent cooperatives. The Project has recently obtained financial support from the LHS GEMS project and the Hughes Medical Foundation to assist in the institutionalization of the course, workshops, and teacher's guides. With this assistance, PEACHES will continue to offer training programs and continue to publish the teacher's guides. The first PEACHES guide, *Tree Homes*, will be published through GEMS in May 1993. Los Medanos Community College, San Jose City College, and Pacific Oaks College are committed to offering PEACHES courses and workshops for credit.
F. Summary and Conclusions : For the 1,245 educators who have experienced our program we have seen an increase in eagerness and confidence in doing simple science activities with preschoolers and K-2nd grade children. For the young children who have participated in our hands-on activities, we know we have enriched their learning experience, and stimulated their natural curiosity to explore the world around them.

This project has improved preschool and early childhood educators' knowledge and understanding of science concepts, and has increased their competency to provide science activities to young children. A network of 2,540 early childhood educators has been created to support and improve the implementation of preschool science curriculum and professional development programs. The permanent impact of this program and curriculum has been to institutionalize a model which can be replicated across the nation to increase and strengthen science education for teachers and children. LHS continues to work with State and National networks to assist in the broad dissemination of the PEACHES teacher enhancement program.

FIPSE Final Report 11/92

A. Project Overview

For more than sixteen years, The Lawrence Hall of Science (LHS) has developed and taught science and mathematics activities for preschool children and their teachers. It is from this pool of parents and teachers that LHS has received numerous request for materials and training to present science and mathematics in a positive and stimulating manner to youngsters. Early childhood educators, in general, have little background in science and mathematics with even less training in how to teach these subjects. Young children, at this formative time in their lives, benefit greatly from hands-on discovery experiences that help them construct an understanding of their environment and that foster necessary problem-solving skills.

From this need and experience, LHS has developed a science and mathematics education enhancement project for child care providers and preschool teachers entitled PEACHES-Preschool Explorations for Adults, Children, and Educators in Science. The project has expanded preschool educators' science knowledge, and enhanced their teaching skills through their participation in a program that integrates content, teaching strategies, networking, and experience teaching an activity-based science/mathematics curriculum for preschoolers. Throughout this report, when we speak of science education we are also including mathematical concepts that are integrated with physical and life science activities.

The project has improved the participation of female, minority, and inner-city teachers in science and mathematics. Spanish-speaking teachers in particular have benefited from the translated materials and bilingual classes.

Over 1,100 early childhood educators have participated in FIPSE courses, workshops, and conference sessions and have provided tremendous positive feedback on both the training and curriculum activities. These teachers along with 1,400 other individuals and early childhood groups make up the LHS PEACHES network of educators dedicated to improving science and mathematics education for young children. The PEACHES educators continue to take courses and workshops through LHS, local community colleges, and early childhood professional group conferences. A May 1993 conference will feature the *Tree Homes* PEACHES teacher's guide; the first FIPSE PEACHES guide to be published through the LHS curriculum project GEMS-Great Explorations in Math and Science.

B. Purpose

In an age when quality care and instruction for preschool children is in high demand, there is a critical need for competent instructors prepared to stimulate and guide the learning of young children. Educators throughout the U.S. recognize the shortage of trained instructors, at all grade levels, who are confident and competent to teach science and mathematics (Begley and Cohn, 1988). The lack of knowledge about science and mathematics education is even more pronounced in early childhood educators, since these subjects have not been part of most traditional preschool curricula (Richard, 1973; Bennett, 1978; Hays, 1984).

Demographic data indicate that the typical early childhood teacher is a woman in her mid-twenties to late forties, and a single parent who faces employment conditions similar to those in other female-dominated fields: low pay, low status, and little job security. Early childhood education programs suffer from a high staff turnover rate of 36% for teachers and 48% for assistants. This attrition has created a shrinking pool of trained teachers with younger, less-trained teachers entering the field (Ruopp, 1979; Child Care Employee Project, 1988).

There are more than 7,000 child care providers in the California counties of Alameda and Contra Costa. Local community college certification programs for early childhood instructors and assistants require only 2 units in science and math out of a total of 46 semester units to meet the California State Department of Education requirements. To receive a Children's Center Instruction Permit in California an individual needs 12 semester units in early childhood education, only one of which is required to be in a curriculum area such as science (State of California Health and Welfare Agency, 1988). This permit is required for instructors who work in centers funded by city, state, and federal agencies.

In the past, social pressures have made education in mathematics and science "undesirable" for women. It wasn't considered "feminine" to succeed in mathematics and science or to be interested in machines and technology. The result of these pressures is that the majority of early childhood teachers feel insecure about their capabilities in science, and are provided with inadequate training and support in this area. In fact, early childhood educators may consider a teaching career with young children because it requires little, if any, background in science (Sprung, Froschi, Campbell, 1985).

Many child care providers indicate that helping children discover for themselves, and thus grow in their development, is the greatest source of satisfaction in their work (Pettygrove and Whitebook, 1984). However, many of these same caregivers have little or no direct experience with the natural world and unwittingly pass on fears and negative attitudes to children about ants, spiders, beetles, and other common urban creatures. These attitudes stifle the child's natural curiosity and can develop into lifelong limitations to learning.

Teachers provide important role models for young children, and children often reflect their teacher's positive and negative attitudes. Girls especially tend to stay physically closer

and to model the behavior of their teachers. If teachers are indifferent or avoid mathematics and science activities, those students who need extra motivation and encouragement will not pursue them (Sprung, Froschi, Campbell, 1985).

The ability of very young children to profit from interactive science, in which they are the discoverers, is well documented (Piaget, 1973; Howe, 1975; Bank Street College of Education, 1977; Kamii and DeVries, 1978; Benham, 1982; Forman and Kuschner, 1983; Smith, 1987). Research shows that activities that encourage active exploration and increased verbalization contribute to the child's construction of knowledge. Science activities offer interesting materials and topics that motivate both the teacher and the child to investigate the world around them. Furthermore, such early explorations promote interest in science which can remain with the child throughout life (Smith and Johnson, 1981). Participation in science activities that build children's visual-spatial and problem-solving skills will help prepare preschoolers for their role in the twenty-first century as informed and productive citizens (Sprung, Froschi, Campbell, 1985).

Our project worked with an experienced pool of parents, preschool teachers, K-2nd grade teachers, child care providers, and home day care teachers. Most had many years of experience as early childhood teachers, yet few had a background in science or had taken courses in science education for young children. Teachers commented on their science and math phobia from childhood and attributed their insecurities about teaching science to the lack of support from a society that thought science unsuitable for females to pursue. All teachers agreed that the concrete and interactive nature of science makes it an important curricular area in the preschool program. We found that although teachers would report that they were doing little science and math in their classroom, further discussion showed teachers presenting science in the form of cooking projects, water play, sorting and grouping activities, and nature walks. Participating teachers were very enthusiastic about the integrative approach of the PEACHES activities, and readily incorporated the science investigations, language arts, math, and movement activities into their existing curriculum.

C. Background and Origins

For more than sixteen years, the Lawrence Hall of Science at the University of California at Berkeley, has developed and taught science activities for children ages 2-6 years and their teachers. Our research and experience has shown that large numbers of children spend significant time with preschool teachers who have little background in science, and that science is generally considered the weakest area of the preschool curriculum. This same research has revealed that most early childhood educators are eager for training, professional development and experience teaching science, and with such support would include science activities in their curriculum.

LHS receives hundreds of requests each year from parents and educators for materials and training to present inexpensive science activities that are suitable for very young children in a preschool environment. Many centers require that their employees take an early childhood education course each year.

Improvement Over Existing Practice

The rationale for the program's design is based on several years of informal research into the backgrounds, working environments, professional, and personal needs of our target group. Many child care providers and preschool teachers have young children of their own and work part-time in year-round preschools or day care settings. The costs of child care and loss of wages make it difficult for them to attend mid-week classes. Preschool teachers often question their own ability to do, let alone teach, science. Preschools vary tremendously in philosophy, curriculum, the nature of the learning environment, and the levels of staff experience. Preschool teachers often feel isolated from other teachers and outside the network of professional development opportunities for teachers.

With these factors in mind, the project used the following strategy to insure the widest and most effective access for preschool educators: 1) The course was spread over an eight week period to maximize the opportunities for participants to incorporate what they learn into the activities they teach to their children; 2) Science content was presented in conjunction with science activities, learning theories, and teaching methods to give teachers a framework and rationale for continued learning of science knowledge and translation of that knowledge to the classroom; 3) The curriculum features fun science investigations to promote teachers' self-confidence and enthusiasm in doing science, and to motivate them to use science activities with children; 4) The program was interwoven with biology, mathematics, physical science, communication, and cooperative learning activities to give teachers experience in ways to combine science with existing language, social, and sensory-motor curricula; 5) The rationale and methods for providing equal opportunities for females, minorities, and disabled people to pursue science was presented in the context of the science activities to provide teachers with concrete examples of how to teach students with various learning needs; and 6) Structured and informal opportunities for teachers to share experiences with other preschool educators was provided to build long-term collegial relationships that strengthen science education efforts in the participating preschool programs.

The commitment of LHS to provide science education for the young child and the preschool educator is strong as evident by the many ongoing programs for individuals, preschools, and child care centers; however, the program has been limited to those who have the time, transportation and money to participate. By taking tuition-free science activities and training to community child care centers and early childhood conferences, the Project increased its positive and creative influence on preschool science education, and demonstrated

an effective approach to teaching science for child care providers that can be adopted by science centers and colleges. Early childhood educators from local community colleges continue to use project materials in their child development courses.

Early Childhood Community Networks

The project course for preschool teachers incorporated effective strategies for long-term implementation of science teaching methods and curriculum that have resulted from our involvement with a number of area schools. LHS has been an active member of the San Francisco Science Collaborative (SFSC) since the Collaborative was established in 1985. Each year the project staff teaches a summer institute for elementary school teachers. In partnership with SFSC, project staff also conducted a K-2 teacher enhancement program funded by the Association of Science-Technology Centers (ASTC). A similar on-going relationship with partnership grants exists between LHS and the Richmond, Oakland, Vallejo, and Pittsburg Unified School Districts. Participants of these programs return to their schools with the curriculum and science materials, and serve as the resource people for their school. LHS maintains contact with the teachers and their schools through follow-up workshops, newsletters, meetings with teacher planning and inservice groups, and informal telephone contacts to refer teachers to science resources.

The Lawrence Hall of Science established support and commitment to the Project from numerous community networks, projects, preschools, and community college centers involved in early childhood education in the San Francisco Bay Area. The LHS Early Childhood Education Program is well-known and respected for its innovative and age-appropriate classes for preschoolers. Thousands of preschoolers participate in weekly science classes at LHS and in their own classrooms with LHS activities. Educators from private and public schools have rated LHS teacher education programs and curriculum materials very highly. Those LHS programs designed for early childhood teachers and students have shown the most significant growth in attendance and demand over the past 16 years. The following groups have maintained a strong relationship with LHS and are dedicated to the Project's goal to enhance the science teaching skills of preschool educators, thereby improving the quantity and quality of science experiences for young students.

Hewlett-Packard Company

The Hewlett-Packard Company has funded project materials for teacher participants to use with children in their schools and centers. Because most preschools have meager funds for science supplies, this provision of materials has helped teachers conduct the *Animal Homes* activities immediately following the training workshops and courses. Hewlett-Packard funds were also used to support the bilingual workshops and materials translated into Spanish.

La Raza Information Service, Inc.

La Raza is a bilingual multi-service non- profit organization designed to meet the needs of low-income Spanish-speaking families and to provide technical assistance to public agencies in the San Francisco Bay Area. La Raza did an excellent job of translating the four teacher's guides and in sponsoring a Project workshop held at San Francisco State University for Spanish-speaking educators.

Merritt, San Jose City, Los Medanos Community, and Pacific Oaks Colleges

Two of the 18-hour courses were offered for credit through the Early Childhood Education Program of Merritt College in Oakland, California. Merritt College is a member of the California Community College System. The third course was offered through Los Medanos College in Pittsburg, California. All four colleges continue to offer workshops and courses based on the PEACHES curriculum.

BANANAS Child Care Information & Referral and Parent Support Center

For the past fifteen years, BANANAS has been working with early childhood educators in many capacities, including teacher education. This community resource center conducts community college courses each semester, provides on-site consultation to centers, and utilizes professional volunteers to conduct workshops on a variety of early childhood concerns and issues.

BANANAS provided its large meeting room for the courses, and distributed flyers to publicize the courses. Information about the program was also disseminated through the BANANAS Newsletter which is sent to about 10,000 people. The project continues to collaborate with BANANAS on workshops and courses presented through LHS and local colleges.

California Child Care Resource and Referral Network (CCCR&R)

CCCR&R was founded in 1980 to support and promote child care resources and referral services. The Network currently represents 72 member agencies in 58 counties. As a statewide child care organization, the Network maintains regular contact with public and private sectors of the child care community. CCCR&R maintains a resource bank on all aspects of resource and referral services and produces a national directory of CCCR&R agencies and a national quarterly journal. CCCR&R continues to support the project by using its resources to publicize and disseminate the project.

Child Care Employee Project

The Child Care Employee Project, based in Berkeley, California, is a national advocacy organization for child care providers seeking to improve their wages, status and working conditions. They provide resource materials and technical assistance throughout the country. Their research has indicated that programs, such as those outlined in this project, are necessary to help improve the quality of early childhood education. Dr. Marcy Whitebook, Executive Director, continues to support to the project through her Child Care Employee Project's current research and data on working conditions of preschool educators.

Oakland, San Francisco, Berkeley, and Alameda Head Start

The Oakland Head Start Program has been in operation since 1968 and is one of the oldest Head Start programs in the Bay Area. They provide center programs for preschoolers, education programs for parents, and home-based health programs for families. Presently, Oakland Head Start runs programs at 12 centers serving over 500 preschoolers and their families. Oakland Head Start staff continue to participate in the PEACHES project by hosting a workshop and trial-testing project materials. San Francisco, Berkeley, and Alameda Head Starts are very enthusiastic about the project and continue to be active in workshops and trial-testing.

Hayward, Oakland, and Pittsburg School Districts

Three local unified school districts have continued to support the project in the form of teacher participants, use of preschool classrooms, program publicity, testing of curriculum materials, and support for more science education beyond the life of the grant. Hayward, Oakland, Pittsburg Unified School Districts have a total of 36 preschools, serving 1440 students. Preschool staff include site administrators, head teachers, teachers, assistants, and parent volunteers. Each district provides some inservice classes with release time for staff. Hayward Unified School District's Peixoto Children's Center, for example, has enthusiastically participated in the course and the testing of the *Tree Homes* Teacher's Guide. In addition, Oakland and Pittsburg districts have implemented the project materials into the primary grade levels, and Kindergarten through 2nd grade teachers have participated in the program. Pittsburg has recently adopted three PEACHES units into their district science curriculum. By 1993 all Pittsburg Kindergarten and 1st grade teachers will be required to present PEACHES activities to fulfill mandated science goals and objectives.

Centro VIDA Children's Center and Skytown Preschool

VIDA Children's Center is a preschool and grade school for predominately Spanish bilingual students in Berkeley, California. It is funded by the Bay Area Hispano Institute for Advancement, Inc. and United Way. VIDA continues to enthusiastically support the project and has provided classroom facilities for workshops and a pool of Spanish-speaking educators

for consultants to the Spanish translated guides and Spanish workshops. Two former Centro Vida staff have co-taught workshops in Spanish and have edited the translated guides.

Skytown Preschool and Parent Cooperative is one of 15 preschools that participates in a series of science workshops at LHS throughout the school year. In the past 13 years, this group of dedicated early childhood educators have worked with LHS staff to integrate their curriculum with science units by bringing their students to LHS for classes. We have learned that parents and staff have become resource leaders and assist their colleagues in teaching the activities. Skytown Preschool staff and staff from other private preschools have eagerly participated in the course as they have even fewer opportunities for staff development than their colleagues in public school districts.

Harold E. Jones Child Study Center

The Harold E. Jones Child Study Center is part of the Institute of Human Development of the University of California at Berkeley. The Institute was founded in 1927 and that year opened one of the first nursery schools in California. The school has been in continuous operation since then, serving the University and the community as a research and demonstration facility. The Center's preschool facilities have a wonderful array of science and mathematics equipment, live animals, garden areas, and computers. Extensive observation galleries throughout the nursery school enable educators and researchers to easily view children engaged in indoor and outdoor activities. Barbara Scales, Director of the Center has continued to support the project by providing presentations on the importance of play and hands-on activities in the preschool environment.

D. Project Descriptions

Recruitment and Participant Selection

In order to best reach our target group, we made use of several established networks in the preschool community. Informational flyers were included in mailings and newsletters to preschools, child care centers, and individuals, through early childhood agencies and programs such as BANANAS, CCCR&R, University of California Child Care Centers, City College Child Development Programs, Unified School District Preschool Programs, Private Children's Centers, and the LHS Early Childhood Education Program. Emphasis was placed on seeking low-income and minority adults from urban communities. Project incentives included a tuition-free one-unit course, classroom materials, five teacher's guides and handbook, college credit, and opportunities to share curriculum and experiences.

Applicants to the course and workshops were asked to describe their experiences working with preschoolers, their personal experience in science and mathematics, and the background of the children that would participate in the science curriculum. Course applicants were also asked to include a letter of support from a supervisor or college

instructor. Participants were selected on the basis of: 1) needing the course to fulfill child development requirements for licensing or credentialing; 2) expressing a need to learn more science content and preschool science activities; and 3) working with minority urban preschoolers at-risk. Special consideration was made to include minority adults and Spanish-bilingual teachers. Participant selection for the course was also based on geographic distribution, teams of two applicants, and the type of preschool setting of the applicants. Preschool settings ranged from home day care to State and Head Start-Funded preschools to college/university-sponsored children centers. An attempt was made to accept teams and individuals from diverse settings and urban areas.

The course participants come from a diversity of school settings: family home day care, private preschools, school district preschools, university and college centers, and government-funded preschools, including Head Start programs. Ninety-four percent of the teachers taught in urban settings and worked with ethnic-minority preschoolers and children at-risk. Sixty percent of the teachers are of an ethnic-minority and represent 10 East Bay cities including Oakland, Berkeley, Richmond, Alameda, and Pittsburg. One participant traveled 300 miles from Redding, California to attend the course. Ten percent of the participants are Spanish-speaking and work with Spanish-bilingual children.

The College Courses

During each of the three years of the project, a science content and methods course was presented to thirty-two child care providers, preschool and elementary school teachers, assistants, and parents working in cooperative child care sites from the San Francisco Bay Area. The biological and physical science content of the course was taught through a combination of activity-based lessons in the form of simulations, games, and investigations that provided the foundation for basic understandings of living things and objects, and their relationships to the environment. Methods and philosophy regarding how to effectively present hands-on activities to children were included in the course through demonstrations, activities, and discussions.

The course included activities and discussions related to topics such as animal habitats, food chains, animal behavior, and use of manipulatives to explore mathematical relationships. Each day featured key themes in mathematics and science, and teaching strategies that promote exploration and problem solving. Sessions in the morning and early afternoon involved participants in classroom activities that present concepts in the theme area as well as provide background information to help build the participants' foundation of knowledge.

For example, the course began with the theme of animal behavior and a focus on the process of observing which is central to all science. Teachers learned how to collect and report sensory observations of animals and children, and how to avoid jumping to conclusions and making anthropomorphic comparisons and assumptions. Their experiences as "behavioral

scientists" provided the pedagogical basis for using a discovery approach to teaching young children. We explored the ways that young children can measure, record, organize, and communicate their findings, as well as strategies for promoting cooperative learning and language skills.

On another day, teachers learned how energy cycles through natural systems as soil organisms break down and decompose dead plants and animals, thereby making the nutrients and minerals available once again to plant roots. Teachers examined soil and observed earthworms, isopods, and other small organisms in soil. After they investigated soil and garden animals, teachers took part in activities from *Homes on the Ground* that involves making classroom terraria and observing changes in the soil and the life cycles of plants and animals.

The teachers left each session with a teacher's guide and science materials to try with their children. Comment cards from the teachers were turned in each session. The comments were overwhelmingly positive, and reflected the tremendous amount of learning taking place with the teachers and their children. The following sample is typical of the feedback submitted by participants.

> "This class has been GREAT!!! The ideas that I have used so far in my school have all gone over very well. I also feel that I've learned a lot about animals and their homes - and I feel more comfortable in presenting these ideas to the children."
>
> "Although I may be squeamish about ants and earthworms I can now get the children to appreciate them without inhibiting their wonder with my apprehensions."
>
> What did you learn today? "Science is easy. Science is fun. Everyone can do it. Everyone can learn something."
>
> "I learned a simple and appropriate way to present the topics involved with tree homes to preschoolers. These ideas can be used to generate many activities to stimulate young children's curiosity about nature and science. The participants were helpful in providing many additional ideas for curriculum planning."
>
> I appreciated that the craft projects were not recognized as "Art" but science. Also that there were no wrong ways for the child to make the owl. I feel that is something very strong to be said aloud. I felt the structure of the tree leads to so many projects that it's incredible. Just that was worth today!!
>
> "I love the way that science is being presented. Not only do I understand it, but it is made simple enough so even a child could understand it. This makes me feel very comfortable in teaching science, as I was never comfortable, or thought that I had enough knowledge to teach it to someone else. Thank you!"

To successfully complete the course and receive one unit of credit, participants had to attend all course sessions and participate in all activities, teach at least two of the units with their children, and submit written feedback on those units to project staff. The third community college course of the Project was held in October and November 1991 at Los Medanos Community College. The course was taught be Patsy Sherman who completed the Year Two course and is a child development instructor at the college.

In December of 1989, the PEACHES Project received a four-year grant from the National Science Foundation (NSF) to present two 70-hour science courses for a total of 60 preschool teachers. The NSF program features the *Animals and Their Young* curriculum and includes six teacher's guides. The content and process of the guides compliment the *Animal Homes* curriculum and continue to present preschool science in an inviting and fun manner. Participants from the first NSF course included many FIPSE teachers, and again, these educators voiced high praise for the preschool materials and course.

The Teacher's Guides and Handbook

At the end of each course session, participants were provided with a trial version of one of the four *Animal Homes* Teacher's Guides titled *Tree Homes, Homes on the Ground, Ant Homes Under the Ground,* and *Pond Homes.* The guides reinforce the science process, content, and methods from the course by providing activities that use this approach with youngsters. Strategies for how to identify, reinforce, and extend science concepts to young children were included in a Handbook to assist teachers in using the science units. Feedback from the courses, workshops, and written evaluations were incorporated into each guide to produce a trial I and trial II version of the guides and handbook.

Although interactive sensory activities can be found in most preschool curriculum, there are few published curricula that integrate language, art, life science, physical science and mathematics into highly motivating and process-oriented activities for preschoolers. The *Animal Homes* curriculum uses an activity-based discovery approach that allows children to learn science concepts through play, drama, games, and art, as well as through observation, comparison, and discussions. The curriculum addresses the varying learning modes of young children and their need for concepts to be presented in a fun and physical manner. Simple mathematics activities such as sorting, counting, measuring, and recognizing patterns, are woven into investigations of relationships in the child's environment. Teachers find that the curriculum also builds skills in cooperation and communication.

Activities in the *Animal Homes* series focus on a specific animal: where it lives, what it eats, and how the young are cared for by the parents. Student projects and dramatizations not only teach the desired concept but give the children the opportunity to take their experiences home to share with family and friends. In one of the *Homes in a Pond* activities, the children learn about animals that visit the pond in search of food and water. The children pretend they are raccoons with nimble fingers when they feel in a pan of muddy water for something to eat. Plastic fish, turtles, and crayfish are the mystery "food" items at the bottom of the pan that the children discover through their sense of touch. The trial II version of the four guides and handbook have been included with this report.

The Great Explorations in Math and Science-GEMS Program will continue to support the publication of PEACHES guides as funds become available. This Fall, 70 preschool

through first grade classrooms from around the country participated in the GEMS/PEACHES National trial test. Their feedback along with the feedback of local PEACHES teachers will be incorporated into the final published guides. In May 1993, *Tree Homes* and *Ladybugs* will be published.

The Saturday Workshops

Tree Homes, Pond Homes, and Ant Homes under the Ground were presented in Years One and Two in eight Saturday classes. These classes were presented to 245 educators unable to attend the multi-week courses. The workshops were conducted at public child care centers and preschools that serve urban and minority populations such as Centro VIDA Child Care Center, Oakland Head Start, and Los Medanos College Children's Center. Two Spanish-speaking teachers assisted LHS staff with two presentations of *Tree Homes* in Spanish to encourage the participation of Spanish-speaking teachers and parents. Later, participants provided written evaluations of the activities they used with children. This feedback was used to modify the activities prior to revising the teacher's guides in English and Spanish. The response to the workshop sites and workshop activities were very positive. The teachers again enjoyed the opportunity to share their teaching experience and to learn about other preschool programs.

PEACHES Library

A collection of children's books and adult science resource books are available to the participants of the courses and workshops. These resource materials compliment the topics presented in the class sessions and units. Teachers are able to check out the materials from the PEACHES Library. PEACHES teachers have appreciated the collection of children's literature that can be integrated with the *Animal Homes* topics. The Library will continue to add new books to the collection to be used by teachers and their children.

Conference Workshops and Dissemination

In Year Three, project staff disseminated the model course and materials throughout California and the nation by conducting workshops at conferences for 800 early childhood educators, science educators, college professional development staff, and science center education coordinators. The project staff attended the national and regional annual conferences of Head Start in San Diego and Sacramento, California. Other conferences we attended included: California Association for the Education of Young Children (CAEYC) state conference, Southern and Northern California Chapters of CAEYC regional conferences, the Northern California Kindergarten Association conference, San Francisco, Oakland, Pleasanton, and Pittsburg Unified School Districts Early Childhood conferences, the Bay Area Science Project Spring Conference, and workshops sponsored by early childhood consortiums.

Multiple workshops were presented at each conference with 30 to 125 teachers attending. There was tremendous enthusiasm for the training and teacher's guides as was evident by the large enrollments and positive feedback submitted to the project. The comments applauded the efforts of PEACHES to address the need for science education programs for the preschool teacher and especially to meet the need for appropriate interdisciplinary science activities for the preschool child.

Project staff also disseminated PEACHES information at National Science Teacher's Association (NSTA), Association of Science and Technology Centers (ASTC), and National Science Foundation (NSF) , and CAEYC annual conferences through booths and table exhibits. The response to the PEACHES Project at these gatherings was again very enthusiastic.

Locally, information on PEACHES workshops, courses, and activity guides have been disseminated by the BANANAS Child Care Information & Referral Center, the University of California, LHS, and GEMS. More than 24,000 people have received information on PEACHES through special mailings, U.C. press releases, and newsletters (Appendix A). An additional 2,000 people have been introduced to PEACHES through contact with participants, early childhood groups, LHS education programs, and special LHS events such as Earth Day. Visiting educators from Japan, Spain, England, Portugal, Chile, and Italy have taken great interest in the Project and have returned to their countries with copies of the PEACHES guides.

E. Project Results

Pre-Course Survey

Selected teachers were given a survey (Appendix A) to complete prior to the beginning of the course. Participants were asked to indicate the frequency of teaching science to preschoolers, their confidence in teaching science, background in science and their goals in preschool education. The following table shows the response of course participants to key questions from the survey.

		Yr. 1	Yr. 2	Yr. 3
1.	Taught science 1-2 times per month or less:	71%	70%	39%
2.	Felt somewhat or not at all comfortable teaching science to children	45%	40%	29%
3.	Most recent contact with science in high school	44%	44%	63%
4.	Number of years working with preschoolers	10.6	10.9	4.1 years per teacher
5.	Completed High School with some college	41%	27%	75%
6.	Completed Associate of Arts Degree or other degree	59%	66%	25%

Evaluation

The Project administered evaluation questionnaires, interviews, and surveys to course and workshop participants. These sources of information were used to evaluate the program in the following areas:

1. Formative feedback on course and curriculum (through comment cards, evaluation of specific activities, and final course evaluations);
2. Teachers' uses of materials and techniques, (through feedback on uses of activities in classes, final course evaluations, and follow-up surveys);.
3. Impact on teacher knowledge, attitudes and instruction, (through surveys, comment cards, final evaluations, follow-up surveys, and interviews); and
4. Impact on children's knowledge and attitudes, (through case studies in Year Two, and teacher assessments on final evaluations).

Each week the course participants were asked to fill out a comment card (Appendix A) which asked three questions: 1) What did you learn today?; 2) Was anything difficult or confusing?; and, 3) Other comments? In general, the comments were detailed and lengthy for question #1, brief or left blank for question #2, and positive, enthusiastic and appreciative for question #3. This response was consistent for all four days of the course and for all 3 courses.

The participants have responded very favorably to the science activities, small group discussions, and homework assignments. The course included additional time for small group discussion and planning. Teachers also shared the science and math activities that they have been doing in their preschools. These sharing sessions have led to collaborations among teachers from different preschools. The following comments are indicative of the impact made on teachers and their children:

> "I like the kits. Even though they were designed for preschool, one can incorporate the basic information to primary grade levels. This class should be a prerequisite for early childhood ed."
>
> "PEACHES is an excellent way to teach teachers and preschoolers math and science. I am already experiencing success with my children and parents."
>
> "I especially enjoyed the sharing with other groups of specific activities they use in their science and math curriculum."
>
> "You must keep going- you are affordable and motivating in the science arena for young children. Inner city teachers and children need you!"

Teachers' Uses of PEACHES Materials and Techniques

As part of course requirements, teachers used selected activities in their classrooms and reported on the results. Survey responses indicated that the teachers were able to implement the activities successfully.

Teachers received an evaluation for each of the four activity guides (Appendix A). The evaluation asked for written comments on the successes and problem areas of each activity after presenting it to preschoolers. The evaluation also asked for the amount of time to prepare for the activity, the overall appropriateness of the activities, and modifications suggested for the revision. Participants were required to complete two evaluations for course credit. All teachers were aware that their comments were a necessary part of the revision and that they will receive a final published copy of each guide that they evaluate. The participating teachers will also have their names and school included in each guide as a contributing evaluator and test site.

Final Course and Curriculum Evaluation

Teachers' ratings of the course and curriculum materials are overwhelmingly positive. Ratings on all aspects of the course average 4.5 to 5.0 (out of 5.0) for all three groups. Teachers gave an enthusiastic appraisal of the quality of the activities and materials, and of the format and organization of the course. Materials and activities were considered age-appropriate, engaging and exciting, and easy to implement in day care and preschool settings. There were virtually no suggestions for changes in the course or materials, nor any major areas of difficulty reported in understanding or using the activities.

PEACHES Final Course Evaluation

Item	Spring, 1990 (n=30)	Fall, 1990 (n=29)	Fall, 1991 (n=29)
Preschool Science Activities	5.0	4.9	4.9
Science Activities for teachers	4.9	4.9	5.0
Method of Presentation	4.9	4.9	4.9
PEACHES Activity Guides	4.9	4.9	4.9
Science Activity Kits	5.0	5.0	4.9
Library Resources	4.8	4.75	4.5
Group Discussion Session	4.7	4.6	4.9
Overall quality	4.9	5.0	4.9

In the final course evaluation, 78% of the teachers reported teaching more science--with most reporting a frequency of 2-3 times per week. Many noted that they were incorporating science into other areas of the curriculum, "throughout the day." Teachers' self reports indicated that nearly all felt a direct positive impact on their level of confidence in teaching science (90%) and on their teaching techniques (67%). They reported that they were more comfortable using science activities in the classroom and had an expanded concept of what science really is and how to get that across to children. Teachers said they added more

"drama," more hands-on activities (particularly with living animals), more questioning techniques to their instruction, and were much more enthusiastic about teaching science. In the follow-up survey, nearly all teachers reported positive changes in their attitudes (toward animals, using the out-of-doors, and observing living in natural things), their confidence (in teaching with animals and in doing science), and their instructional approach (in keeping animals in the classroom and in integrating science into other areas of the curriculum).

Impact on Children's Knowledge and Attitudes

With each course participant teaching an average of 15 children, at least 1470 children of course teachers have experienced science activities through PEACHES. Three-fourths of the teachers described positive, specific changes in children's behavior, usually in the form of greater interest and greater respect or caring for nature, animals, and the environment. Some teachers also noted improvements in children's vocabulary and levels of questions asked, as well as good retention of the facts and concepts introduced in the science activities.

Year Two participants were required to conduct case-studies on 1-3 children who would experience *Homes on the Ground* activities (Appendix A). The children were given a pre-test before the activities to assess their knowledge and attitudes regarding ground-dwelling animals and habitat. Following the interview, the children's behaviors were observed during and after the activities. A post-interview was conducted with the children to record any changes in attitudes or knowledge. The teachers submitted the interviews, observations, and a summary on the last day of the course. The teachers felt that the case study was a valuable tool for assessing their children, and enjoyed the opportunity to conduct a pre- post- test with a select group of children. Results indicated that the children did learn the facts and concepts presented in the lessons and were able to describe what they had learned. Also, there were many examples of children changing from an attitude of insects, etc., as "yukky" to a fascination or even caring for the living creatures.

1991 Follow-up Evaluation

In May 1991, a follow-up survey was administered to the Year One and Year Two course participants. The purpose of the evaluations was to assess the impact of the Project six months and one year after the end of the courses. Participants were asked the following : whether the activities were still being used with their preschoolers, whether colleagues are using the activities, whether the participants are still using the discovery-method approach to teaching science and math, if other science and math activities have been implemented, and whether their children are continuing to benefit from hands-on science. The survey was administered as on-site interviews, phone call interviews, and as a written survey mailed to participants' homes.

In the follow-up survey for the Year One and Year Two group, all respondents indicated that they continued to use PEACHES techniques and materials. Of the seven techniques listed, most teachers continued to use at least four (e.g., observation of natural things, craft projects, role play, and manipulation of objects). Of eight sets of course materials, most have continued to use at least three or four (e.g., cardboard tree, terrarium, living animals).

Of particular note is the extent to which course participants shared information, ideas, and materials from PEACHES with others. This unexpected dissemination of the program has expanded the network of educators familiar with or using the project materials.

(Number of teachers using each strategy)

Strategy	Spring, 1990	Fall, 1990	Fall, 1991
telephone conversation	17	20	11
informal sharing at preschool	31	27	14
present to colleagues/parents	8	6	5
report to supervisor	20	19	3
having others observe you teach	16	21	6
share activity guides with other teachers	21	22	11
share kit materials	16	17	10
Total number of other adults told about PEACHES	280/Av=10	270/Av=9.3	72/Av 2.5
Number of others using materials	63/Av=2	62/Av=2	39/Av 1.3

An indication of FIPSE participants' desires to learn additional age- appropriate math and science activities to teach to their children is reflected by their enrollments in other PEACHES activities. Thirteen of the 1990 FIPSE participants completed a 70-hour PEACHES preschool science course funded by NSF. Ten FIPSE participants were enrolled in the second NSF PEACHES course. Year Three teachers continue to attend PEACHES workshops and conferences.

1992 Follow-up evaluation

Follow-up surveys and interviews were conducted with 39 FIPSE PEACHES alumni. One to two years following their training, 96% of these participants reported that they were still using PEACHES materials and methods in their classrooms, usually three to five times per week. The 39 alumni who participated in the follow-up studies and interviews reported that, since their training, they have taught PEACHES to a total of 1,020 children, for an average of 26 children per participant.

Participants also reported many positive changes in their own and their children's attitudes toward science in the classroom. Children have become increasingly skilled at paying attention and answering and asking questions intelligently, and have shown a marked increase in curiosity and enthusiasm about science activities. In addition teachers report that their children are more aware of their environment and more caring toward living things in that environment. 100% of the teachers claimed that their confidence in teaching science and math to preschoolers has continued to increase since they took the course.

Finally, 95% of the teachers surveyed reported that they continue to teach more science as a result of their PEACHES training, and that they still use all four of the PEACHES units, *Tree Homes, Homes on the Ground, Ant Homes Under the Ground,* and *Homes in a Pond* regularly and enthusiastically.

Saturday and Conference Workshop Evaluations

The participants of the Saturday Workshops and sessions held at conferences were given comment cards identical to the course comment cards. Their response was again enthusiastic. Many commented on how motivated they felt to return to their site and teach the science activities to their children. The workshop participants were also given an activity guide and an evaluation to return upon presenting the activities to preschoolers. We have received numerous feedback forms with helpful suggestions from teachers all over the country. We continue to incorporate their ideas into guides as they are revised, and send them a complimentary guide of their choice when the feedback is received.

Institutionalization and Continuation

The course and instructional materials have been institutionalized within the LHS educational program and local colleges. The courses and teacher's guides are advertised in the LHS educational brochures, which reach over 15,000 schools. School districts continue to arrange LHS teacher workshops on a fee basis that feature the PEACHES curriculum. Each quarter, a PEACHES course for teachers and parents on a variety of topics is held at LHS. This Fall, the course had 40 enthusiastic teachers and parents who received training on the four FIPSE PEACHES guide. The Project has developed a regional network of early childhood educators interested in promoting preschool science, and continues to use the project materials in its informal education programs for families and parent cooperatives.

The Project has recently obtained financial support from the LHS GEMS project and the Hughes Medical Foundation to assist in the institutionalization of the course, workshops, and teacher's guides. With this assistance, PEACHES will continue to offer training programs and continue to publish the teacher's guides. Los Medanos Community College, San Jose City College, and Pacific Oaks College are committed to offering PEACHES courses and workshops for credit.

F. Summary and Conclusions

For the 1,245 educators who have experienced our education program we have seen an increase in eagerness, confidence, and competence in doing simple science activities with preschoolers, as well as an increased awareness of the skill levels and learning modes of young children. For those that have been given one of our guides, we have broadened their perspective for teaching science activities to preschoolers by giving them new materials to use with their own children and staff.

For the young children who have participated in our hands-on activities, we know we have helped to enrich their learning experience, and have stimulated their natural curiosity to discover and explore the world around them.

Overall, the project provided 18 hours of comprehensive development and training in science for 98 preschool educators and 5 hours of training for 245 educators from 6 counties within the San Francisco Bay Area. An additional 800 educators in California and throughout the nation participated in workshops held at conferences. More than 2,000 educators were contacted at professional conference booths and given information on the model program. Over 25,000 teachers were given program information on the Project through newsletters and press releases. This project has improved preschool and early childhood educators' knowledge and understanding of science concepts, and has increased their competency to provide science activities to young children.

A network of 2,540 early childhood educators has been created to support, improve, and encourage the implementation of preschool science curriculum and professional development programs. LHS continues to work with State and National networks to assist in the broad dissemination of this model preschool educator enhancement program. The wide-ranging and permanent impact of this program and curriculum has been to institutionalize a model which can be replicated across the State and nation to increase and strengthen science education for teachers and children.

Appendix A

Sample Evaluation Comment Cards
Sample Activity Feedback Form
Sample Final Course Evaluation
Sample Case Study
Letters of Support
GEMS Network News article on PEACHES

Comments?

The presenters were fantastic! It was very informative and a fun workshop. I feel I gained some valuable information.

Comments? The Workshop was excellent. you not only gave detail information but hands on activities to enhance learning skills. I really appreciate this work Shop. It has increased by knowledge in the exploration of Science & Math in working with young children.

Thank you..

Comments?

I really enjoyed the ideas, and the upbeat way you presented them.

Hands on is so much more interesting than only listening for 2 hrs!

I will use these ideas in my Classroom!

Thanks

Headstart National Conference Workshop Comment Card 4-30-92

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PEACHES FIPSE Course III Activity Feedback Form -- Homes in a Pond, Version II

Teacher Leeza Glisson School Suddath Elem Did you attend this workshop? no

Number of children doing activities 27 Age (s) 5 Date April 24 1992

1. Mark the activities that you have taught and **add comments**:	How successful were the activities in teaching the concepts?	Rate the childrens' response to the activities:
Chapter 1: Real Fish and Paper Fish		
___ Sink or Float?	1 2 3 4 5 (Low … High)	1 2 3 4 5 (Low … High)
We did this earlier in the year.		
✓ Observing Live fish	1 2 3 4 (5)	1 2 3 4 (5)
We used gold minnows & they worked great! ✓ Building the Aquarium	1 2 3 4 (5)	1 2 3 4 (5)
✓ The Aquarium Home	1 2 3 4 (5)	1 2 3 4 (5)
We sent these home with the children on Friday. We also sent 2 tadpoles with each child!		
✓ Reviewing Great experience!	1 2 3 4 (5)	1 2 3 4 (5)
✓ Going Further	1 2 3 4 (5)	1 2 3 4 (5)
✓ The Fish Drama	1 2 3 4 (5)	1 2 3 (4) 5
This was a little slow for the children, so we added to it.		
✓ Making Paper Fish	1 2 3 (4) 5 (Low … High)	1 2 3 (4) 5 (Low … High)
We do this type activity so often that it wasn't as exciting.		
Chapter 2: The Pond		
✓ A Daytime Pond Drama Little bit low. but we expanded it.	1 2 3 (4) 5	1 2 3 (4) 5
✓ Egg to Frog Great activities	1 2 3 4 (5)	1 2 3 4 (5)
✓ Making Frog Finger-Puppets	1 2 3 4 (5)	1 2 3 4 (5)

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1.Mark the activities that you have taught and **add comments**:	How successful were the activities in teaching the concepts?	Rate the childrens' response to the activities:
✓ Sticky Tongues	1 2 3 4 (5) (Low … High)	1 2 3 4 (5) (Low … High)
✓ Hopping Frogs	1 2 3 4 (5)	1 2 3 4 (5)
[illegible] Going Further	1 2 3 4 5	1 2 3 4 5
✓ A Nighttime Pond Drama	1 2 3 4 (5)	1 2 3 4 (5)
✓ " Raccoons" Go Fishing	1 2 3 4 (5)	1 2 3 4 (5)
___ Going Further	1 2 3 4 5	1 2 3 4 5
Chapter 3: Crayfish		
___ Crayfish Treats (we are not able to use the freezer)	1 2 3 4 5	1 2 3 4 5
___ More Popsicles	1 2 3 4 5	1 2 3 4 5
✓ Making Paper Crayfish	1 2 3 4 (5)	1 2 3 4 (5)
✓ Crayfish Drama	1 2 3 (4) 5	1 2 3 (4) 5
✓ A Memory Game	1 2 3 4 (5)	1 2 3 4 (5)
Chapter 4: Getting Cooler, Getting Drier		
✓ Getting Cooler	1 2 3 4 (5)	1 2 3 4 5

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1. Mark the activities that you have taught and **add comments**:	How successful were the activities in teaching the concepts?	Rate the childrens' response to the activities:
✓ Getting Drier	1 2 3 4 (5) High	1 2 3 4 (5) High
✓ Going Further	1 2 3 4 (5)	1 2 3 4 (5)

2. Children's overall reactions to the unit: (check one)

✓ very enthusiastic
___ enthusiastic
___ mixed (explain)
___ slightly negative
___ very negative

Comments: They were very excited about the unit. The pond in the middle of the rug was a great eye catcher. They were very protective of it all week.

3. Your overall reactions to the unit: (check one)

✓ very enthusiastic
___ enthusiastic
___ mixed (explain)
___ slightly negative
___ very negative

Comments: I enjoyed it. I teach using learning centers and thematic units. To make it a complete unit I had to add a lot to it in the areas of math, language, etc. (over)

4. Was the unit appropriate to the children's level? (check one)

✓ too low
___ about right
___ too high

Comments: I had to add to and expand for my kindergarten class. Adding extra books and learning centers took care of this.

5. Do you feel the students grasped the skills and concepts presented?

✓ yes
___ partially
___ no

Comments: They did! The parents were impressed. Food life is fascinating.

6. How many class hours did you spend on this unit? about 6 hours

7. Did you need more background information? If so, on what topics?

I didn't, but I have taught this unit for 10 years. A new teacher could possibly need more.

8. What suggestions do you have for improving the unit?

Add activities in the areas of math, language, manipulatives, etc.

Send Eggs

Haven't sent Fall

- need address

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3. I always have two large grouptimes and two learning center times. For second grouptime, I used Frog Math. It worked out great! Again, I had to add to the unit to cover all of the areas that I incorporate in learning center time.

Thanks for letting me use this book. I really enjoyed it. I love to pre-view another of PEACHES books

Lisa Gleason

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Final Course Evaluation November 17, 1990
Lawrence Hall of Science
Preschool Explorations for Adults, Children, and Educators in Science

We greatly appreciate your time in giving us feedback on the PEACHES Program. Please circle the number that reflects your evaluation of the following activities:

How do you rate the following? 1 = poor 5 = excellent

1. Preschool science activities 1 2 3 4 (5)
Comments: well planned organized & presented

2. Science activities for teachers 1 2 3 4 (5)
Comments: well planned organized & presentive

3. Methods of presentation in the course 1 2 3 4 (5)
Comments: Very good, enjoyable, held your attention

4. PEACHES Activity Guides 1 2 3 4 (5)
Comments:
Informative & resourceful

5. Science activity kits 1 2 3 4 (5)
Comments: Resourceful
Good information

6. Library resources 1 2 3 4 (5)
Comments: Good

7. Group discussion sessions 1 2 3 4 (5)
Comments: good everybody had something to offer everybody got involved

8. Overall quality of the PEACHES program 1 2 3 4 (5)
Comments:
Excellent

32
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We would appreciate your help in documenting the extent to which PEACHES activities and information have been spread to others.

9. Please indicate how you have shared what you learned in the course. Check the ones that apply:

- ✓ telephone conversations with friends and colleagues
- ✓ informal sharing at your own preschool site
- ✓ small group presentation for colleagues and parents
- ✓ reports to supervisors
- ✓ having others observe you teach the activities
- ____ sharing PEACHES Activity Guides with other teachers
- ____ sharing kit materials with other teachers
- ____ other _____

not yet

10. Total number of adults who learned about PEACHES from you: 13

11. How many of these adults are now using PEACHES activities? 3

We would also like to know if the PEACHES program has influenced your attitudes and teaching methods related to preschool science.

12. Has your level of confidence in teaching science to children changed; if so how?

Very much, Simple way of presentation Science doesn't have to difficult, Gained lots of resources and information

13. Have your teaching methods changed; if so how?

Yes, learned a simple, sequential effective way of presentation

14. Do you teach more science; if so how often?

Yes, at least once a week

15. Have your goals in preschool education changed; if so how?

NO

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16. How many children have you taught the PEACHES activities to? 12

17. Have you observed changes in the behaviors of these children as a result of the PEACHES activities? If so please describe:

Yes, attention span longer motivation and eagerness to get involved noted

Margie Kirk

PEACHES FIPSE Course II - Fall, 1990
Case Study On *Homes on the Ground*

REPORTING SHEET

PART I. Description of Child

Include: a) Age, sex, ethnicity; b) General description of child (language and motor skills, social skills, special interests, etc.); c) Reasons why you selected this child to observe. **Use child's first name only.** I choose a four year old boy who is black. I choose this child because he is very bright and active. His language is English. My special interest in him is to see how long he would be interested in the terrarium. I selected him because his language is clear and he can be very creative. He is a very curious child and always into something.

PART II. Pre-Activity: Mystery Bags

The purpose of this pre-activity is to help you assess you childrens' knowledge, attitudes and experiences with respect to garden soil, sand, leaves, twigs, and other natural things found on the ground. We suggest that you do this activity with your small group **before** you do the drama or go on a ground-home hunt.

If possible, arrange to have an observer record the childrens' responses. Otherwise, make a few notes during the observations and then write down the childrens' responses in Part III. immediately following the session. The following lesson plan has been taken from the PEACHES guide - *Homes on the Ground*, pgs. 6-8 and modified for this assessment activity.

What You Need:

For each group of 1-3 children:

- ❑ 6 paper lunch bags or small paper grocery bags
- ❑ 6 small trays, or paper plates
- ❑ 2 cups of garden soil*
- ❑ 2 cups of peat moss*
- ❑ 2 cups of sand*
- ❑ 4 tablespoons of bird or grass seed *

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- ❑ 1 handful of small dry leaves such as oak, sycamore, maple, or fruit tree leaves*
- ❑ 4 small twigs*
- ❑ 1 spray bottle for water*

(*These materials also can be used in "Activity 4: The Terrarium."

Getting Ready

Several Days Before the Activity

1. If you also will be presenting "Activity 4: The Terrarium," read the "Terrarium Information (For Adults)" on page 15 to learn more about the soil, plants, and animals you will be adding to the terrarium.
2. Gather the soil, peat moss, sand, twigs, seed, and leaves to make the "mystery" bags. **Caution:** Be aware that soils may contain molds, fungi, parasites, and chemicals that can cause health problems for children and adults. Collect soil only from clean areas away from pets, pesticides, fungi, and molds.
3. Write a different letter or number on each paper "mystery" bag to identify them. Write the figures large enough for the children to see them clearly.
4. Place each material into a paper bag. You should have a mystery bag of soil, a mystery bag of peat moss, etc.

Immediately Before the Activity

1. Lightly mist the soil and peat moss if they are dry. This will reduce dust and enhance the natural odors of the soils and peat moss.
2. Arrange the mystery bags on a tabletop near the demonstration area for the children to see. Have the trays nearby. The demonstration area should be a place that you won't mind spilled soil, sand, seeds, or leaves.

How Does it Feel?

1. Tell the children the paper bags contain things you can find outside. They are going to play a game; they can not look inside the bags, but they can feel what is inside. Build up the mystery by saying, "You're going to use your fingers to find out everything you can about what's inside each bag!"
2. Let a child choose a bag by naming the number or letter written on the bag. Allow each child to have one or two turns feeling the material inside the bag. Have them describe what the material feels like (hard, soft, prickly, smooth). Let the children guess the name of the material from the descriptions.
3. When everyone has had a chance to feel and describe the material, open the mystery bag and pour half of it on a tray and say, " What is this? Now we are going to use our eyes and fingers to find out more about the soil (peat moss, leaves, seeds.)" Use the descriptive vocabulary that the children used, too.

4. Let the children explore the material and have them describe the textures, odors, and colors. Some other questions to ask are:
   - Where have you seen soil (leaves, twigs, seeds) before?
   - Have you ever touched soil or dug it up?
   - What kind of animals might live on the soil (leaves, twigs)?

   Encourage the children to describe their prior experiences with the materials.
5. Toward the end of the exploration time, introduce or reinforce the names of the materials that the children have used (soil, earth, dirt, sand, peat moss, leaves, clay, seeds).
6. Continue the process described in Nos. 2-5 with each bag.

Optional (for the assignment):

7. Bring out the mystery bags again and give each child a different bag. Tell the children to feel the material inside each bag, and then find the material on a tray that they think matches the contents of the bag. When the child has selected a tray of material to match the bag, then they may peek inside the bag to see if they are correct.
8. If you have time, let the children trade bags and match the materials on the trays.
9. The children should wash their hands after handling the soil, peat moss, and other materials.

PART III. Description of Childrens' Behavior and Comments during the Pre Activity - *Mystery Bags*

Describe your small group or child's behavior and comments as they participated in the Pre-Activity-*Mystery Bags* activity. Try and be as specific as you can with regards to vocabulary, positive and negative comments, body language, gestures, etc.

PART IV. Description of Children's Behavior during the drama, ground-home hunt, terrarium, and animal activities

Present the other activities described in the *Homes on the Ground* unit. List the activities that you presented and record your observation of the child or childrens' behavior: I observed Tarren with a group of children in a circle on the carpet. I put the terrarium in the middle of the circle on a piece of plastic. Tarren was very excited about the hunt. I explained to the group about the terrarium hunt. I gave Tarren along with five other children a microscope. Tarren went right to work at finding insects. He first found a pill bug and put it in some sand near the terrarium. The teacher said to him, "you are going to kill it Tarren." A boy said to him, "stop picking it up". Tarren didn't seem to pay the teacher or the boy any attention. He just kept busy experimenting with the bug. Next he found a worm. His face lite up and he was glad. He picked it up at once and said in an exciting voice. I found a worm!" He jump up and went to show it off. He came back to the terrarium a played with the worm until it was time to put the terrarium away.

PART V. Post-Activity: *Mystery Bags*

The purpose of the Post-Activity session is to help you assess any changes in knowledge, attitudes, and behaviors resulting from experiences with the Homes on the Ground activities. Repeat the setting, procedures, and questions used in the Pre-Activity. Some changes to look for:

1) Use of words that imply positive and negative attitudes,
2) Level of interest with respect to the topic of soil, leaves, ground animals, etc.,
3) Level of understanding of new concepts such as, soil as a home for animals, or leaves and twigs provide food and shelter for animals,
4) Descriptions of new behaviors such as digging in the soil, finding or touching pillbugs, snails, and,
5) Use of new vocabulary used in the unit.

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PART V.a. Description of Childrens' Behavior and Comments during the Post-Activity - *Mystery Bags*

Describe your small group or child's behavior and comments as they participated in the Post-Activity-*Mystery Bags* activity. Try and be as specific as you can with regards to vocabulary, positive and negative comments, body language, gestures, etc. I did the mystery bags activity with about ten children, ages 4-5. First I explained the mystery bags activity to the group. I told them that the contents of the bags were natural things that we find on the ground daily. I made it plain to them that they were not allowed to look inside of the bags. I told them that they could only feel inside of the bags with their hands. I passed the bag to each child and waited to see his/her responses. The children looked puzzled when they put their hand inside the mystery bags. Some looked like they wanted to scream. One child took his hand out of the bag and wiped his hand on the table. The children repeated answers and vocabulary words given by each of

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PART VI. Summary and Assessment

Review the data collected and recorded in Parts II-V. Write a brief summary of the child's or children's reactions to the *Homes on the Ground* activities and your assessment of what the child gained from this unit. Also, include comments on what you learned about the child by doing the observations.

The children were sitting around the home on the ground active like honey. Everybody wanted a chance to dig in the soil. Then one day we went out to look for bugs to put into our terrarian. I had a group of children of about ten in number. We went over to the planter box with a hoe. We took turns chearing the grass around the planter box in hope of finding some insects to put in our terrarian. But that day we didint find not one bug. Maybe we'll wait until it rains. and after the rain we will go out again on a hunt for insects. Even though we didint find any bugs we had lot of fun hunting for insects.

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Dear Kimi;

I enjoyed this class so much. The benefits of attending were well worth the time, travel, and expense.

I feel so much more confident and relax when it comes to the planning, preparati and presentation of science activities. Your creative presentations helped me to be more creative. Science can be fun and the young child is capable of learning many concepts if presented using the guidelines you followed in yo presentations.

You took great pains in making sure your lessons were developmentally correct. A teacher could easily extend the activities to older children, or modify to meet the needs of the young 3yrold etc. Please Keep me in mind for your class coming up in May. Have you found my evaluatio ? I would like to continue to expand my

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skills in this area of development. I'am saddend by the lose of my evaluations. I took great pains in attending each class and look forward to recieving the 1 unit credit as well as the opportunity to attend other classes.

Please contact me so you can express what I need to do to obtain my one unit. I want to make sure everything is complete.

Sincerely

Dena M. Keown
916-474-3556

Black Butte Kiddie Corr
29897 State Hwy 44
Shingletown, CA 96

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Dear Kimi, Jean, Jaine and all the members of the Peaches staff and also the agencies who so graciously have funded the work of Peaches,

How can I express my gratitude and thankfulness for all you have offered to me?

It was such a precious offering you made to the Peaches students. To me you have made a profound difference and the positive benefits of your gift of experience to me will continue to unfold in time I am sure. Every element of my experience was very positive. The professional, cooperative approach of many educators working together so harmoniously towards a common goal is so inspiring. The thought, consideration, support and beautiful human spirit at work which was communicated to me by everyone involved with Peaches means so much to me! So often as a childcare provider I have felt alone, isolated and poorly-equipped out on my own seperate limb with the very important task of influencing and shaping the minds, hearts and characters of impressionable young people. In my heart I know the work of educators and childcare providers do is important and meaningful. There is, however, in practical terms, so little support to make a challenging job easier.

Peaches is an exception to this irony. Truthfully speaking, there has been, in my 20 years experience in working with children, no event more moving than the impression Peaches has had upon me personally. Every detail of support has helped to uplift my spirit and provide the balm of much-needed acknowledgement and encouragement to give my best to promote childrens healthy development and welfare.

True, the work with children is its own reward and children give so much love and inspiration back to me. Yet, it feels so good to be encouraged and helped to continue and be inspired to reach deeper and higher within myself and the imperfect world of work to promote the ideal of curiosity, exploration, inquiry and discovery. We were as students always welcomed and uplifted by you and I hope you realize how crucial and meaningful the work and labor of love you perform really is! The Peaches program and especially the very professional and loving Peaches staff and the insight of those who fund such a worthy enterprising project is to be highly commended! Thanks a million! I love you for what you have showed. It is priceless and rare, an oasis in a desert, a jewel and gift whose value cannot be measured. Blessings and love. Warmly, Richard Mevmis

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What Is GEMS and How Can I Take Part?

GEMS stands for Great Explorations in Math and Science.

GEMS is a growing series of science and math activities developed at the Lawrence Hall of Science, then extensively tested nationwide, modified for classroom use, and published in teacher's guide format. Presentation of GEMS activities does not require special training in math or science. Materials are easy to obtain. Fun and excitement are combined with opportunities for mastering key content and process skills. There are now over 30 GEMS Teacher's Guides, ranging from 2 to 15 class sessions each, and from kindergarten to 10th grade. Assembly Presenter's and Exhibit Guides are also available.

For a publication brochure or leadership information please write to:

LHS GEMS, Lawrence Hall of Science,
University of California, Berkeley, CA 94720,
or call (510) 642-7771.

The GEMS Network News is published on a biannnual basis by the GEMS project of the Lawrence Hall of Science. Original funding for the GEMS project was provided by the A.W. Mellon Foundation and the Carnegie Corporation of New York, with equipment donations from Apple Computer. Under a grant from the National Science Foundation, GEMS Leader's Workshops have been held throughout the United States. GEMS has also received grants from the people at Chevron USA, the Hewlett-Packard Corporation, and the McDonnell Douglas Employee's Community Fund and the McDonnell Douglas Foundation. This support does not imply responsibility for statements or views expressed in publications of the GEMS program.

Principal Investigator: Glenn T. Seaborg
Director: Jacqueline Barber
Assistant Director: Kimi Hosoume
Curriculum Specialist: Cary Sneider
Staff Development Specialists:
Katharine Barrett, John Erickson, Jaine Kopp, Laura Lowell, Linda Lipner, Laura Tucker, Carolyn Willard
Mathematics Consultant: Jan M. Goodman
Administrative Coordinator: Cynthia Eaton
Distribution Coordinator: Karen Milligan
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Associate Editors: Carl Babcock and Kay Fairwell
Art Director: Lisa Haderlie Baker
Designers: Carol Bevilacqua and Lisa Klofkorn
Shipping and Inventory: Michael Stanton
Staff Assistants:
Nancy Kedzierski, Felicia Roston, Vivian Tong, Stephanie Van Meter

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We welcome letters to the editor, comments, and contributions to the GEMS Network News.

The Lawrence Hall of Science is a public science center; and a center for teacher education, research, and curriculum development.

Chairman
Glenn T. Seaborg
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A Taste of PEACHES

Recent years have seen increasing emphasis on the importance of preschool educational efforts. Many studies demonstrate the crucial difference that positive experiences at early ages can have on child development, from self-esteem and basic social skills to creative ways of learning that provide a solid foundation for later years. The GEMS project has joined forces with a pioneering preschool education project at the Lawrence Hall of Science, and as a result is now testing and plans to publish an outstanding series of preschool guides from the PEACHES program. We asked Ellen Blinderman, a PEACHES instructor and curriculum developer, to provide the GEMS network with "A Taste of Peaches."

Here at the Lawrence Hall of Science, we don't grow our PEACHES on trees. And although you can't bake a pie with our PEACHES, you can use them in a recipe for a rich and fulfilling early childhood science and math program. PEACHES, which stands for **P**reschool **E**xplorations for **A**dults, **CH**ildren and **E**ducators in Science, is a curriculum development and teacher education program whose goal is to help preschool and kindergarten teachers present science and math in a fun and easy way. PEACHES has recently teamed up with GEMS. This exciting partnership means that new GEMS teacher guides, designed for use with four and five year olds, will be available soon. If you've tried and liked *Buzzing a Hive*, *Animal Defenses* and *Hide A Butterfly*, among GEMS guides currently available for this age group, you will be happy to hear that there are many more GEMS/PEACHES guides already in the works.

The PEACHES Project is three years old this fall, but its roots go way back to the early days of LHS. Developing and implementing hands-on, sensory science activities centered around animals and nature has been the focus of the Early Childhood Biology Program since its beginnings, over 15 years ago. The desire to publish some of the most successful activities, making them accessible to other educators, was shared by many of us. The only problem was that money (like PEACHES at LHS) doesn't grow on trees. It took a lot of time, effort, and patience, but at last, in the fall of 1989, the National Science Foundation (NSF), the Department of Educations's Fund for the Improvement of Post Secondary Education (FIPSE), and the Hewlett Packard Company awarded LHS the funds needed to launch and sustain the PEACHES project. As soon as the money was in hand, the PEACHES staff was ready to spring into action, and has been busily growing PEACHES ever since!

In addition to further developing activities for publication, the PEACHES

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project includes teacher education. Of particular interest is to reach teachers who have very little or no science and math background. The PEACHES staff believes that science is for everyone. Adults can guide children in meaningful learning experiences without knowing all the answers. The best model for a child is a teacher who is as curious and eager to learn about new things as the child is!

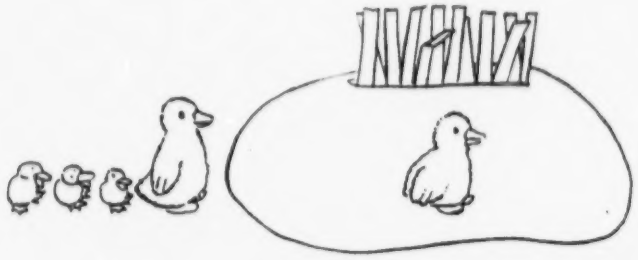
Over the past three years, the PEACHES staff has held five college credit courses and presented workshops at dozens of local, state, and national early childhood conferences. Participants at these workshops receive trial versions of teacher guides. To date, PEACHES has produced 10 trial guides. There are four guides in the "Animal Homes" series and six guides in the "Animals and Their Young" series. All of the "Animal Homes" guides have been translated into Spanish. Each guide has gone through multiple revisions incorporating many suggestions by teachers and parents who have used the materials. In addition, a PEACHES "Handbook for Educators" has been developed to provide an overview of the PEACHES educational philosophy and strategies for presenting activity-based science and mathematics to young children.

Animal Homes
Tree Homes
Homes on the Ground
Ant Homes Under the Ground
Homes in a Pond

Animals and Their Young
Ladybugs
Eggs, Eggs, Everywhere
Ducks and Ducklings
Elephants and Their Young
Mother Opossum and Her Babies
Penguins and Their Young

These two major content areas "Animal Homes" and "Animals and Their Young," are very appealing to young children. They can strongly relate to the importance of a safe and comfortable home and to the universal experience shared by humans and animals alike of being born and growing up. The animals featured in the guides were chosen because they are animals that young children are likely to be familiar with, either through firsthand experiences, storybooks, or perhaps visits to the zoo. Every child, whether she attends school in an urban, a suburban, or a rural community, can discover animals living in a nearby tree, see ants marching on the ground, or find pillbugs hiding under leaves. Of course, live elephants, penguins and opossums are a little harder to find—but PEACHES has found imaginative approaches to bring these animals to life in the classroom.

Realistic dramas presented by the teacher using toy animals introduce the children to animal behavior. For example, In *Ducks and Ducklings*, children learn about the feeding, nesting, and parenting behavior of real ducks, as the teacher uses toy ducks, a paper pond, and some leaves and grass to dramatize a story. The toy animals and other materials are left in an area where they are available to the children to use in their own dramas. Creative role-playing activities such as



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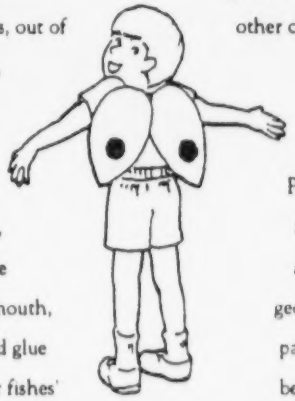
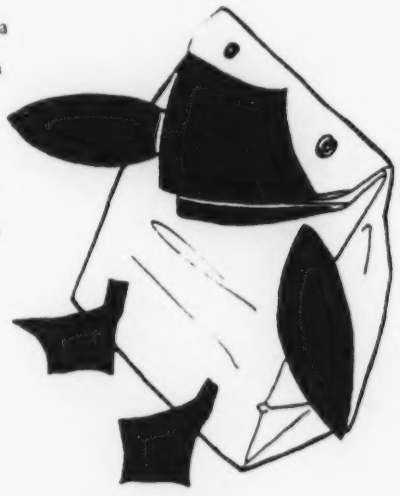
wearing paper ladybug wings and flying to trees to look for aphids, or holding plastic eggs on their feet and huddling close together like penguins on ice, help children view the world from a different perspective. Make-believe play is a powerful mode of learning for four and five year olds.

Constructing models of animals, out of paper and other craft materials, enriches the PEACHES learning experience. For example, in *Homes In A Pond*, after observing a real fish swim, hide and eat, the children make paper fish. They draw eyes, a mouth, and fins on their paper fish, and glue paper plants and flies into their fishes' stomachs. The process of making paper fish helps the children review the physical structure of a fish, and provides a way for them to record their observations of the real fish. The children enjoy playing with the animal models they make and often extend the play at home. One parent told us that her son immediately put his paper bag penguin puppet in the refrigerator the day he brought it home from school because it needed to live in a cold place!



Free exploration of materials is emphasized in PEACHES activities, from soil, leaves, and ice, to rolling objects, toy animals, and small creatures. Providing these opportunities for free exploration encourages the scientist already in every child and provides a natural introduction to experimentation. Simple experiments outlined in the PEACHES guides are open-ended, and easy to set up. In *Penguins and Their Young* children experiment with ice, water and temperature; in *Homes on the Ground* they find out what happens over time when different materials, animals, and foods are added to a terrarium; in *Elephants and Their Young*, the children experiment with water flow. These experiments serve as starting points and spontaneously lead to other child-initiated investigations.

Math activities in the PEACHES guides go hand in hand with the science activities. Exploring geometry, measurement, patterns, and number, becomes a natural accompaniment to learning about animals. In *Mother Opossum and Her Babies*, the children measure themselves next to a full-size poster of an opossum to find if they are longer, shorter or the same size as the opossum; in *Eggs, Eggs, Everywhere*, children explore plastic eggs and other objects and compare how these different shapes roll; in *Ladybugs and Their Young*, children discover symmetry in themselves and in ladybugs; in *Tree Homes* children bring in toy bears from home and sort them into groups by color, size and other characteristics. PEACHES guides are filled with many other creative ideas for integrating math into the units.



The skills the children use and develop in PEACHES activities are applied to many other situations in their everyday lives. Observing with all the senses, comparing, finding relationships, organizing, experimenting, predicting, and communicating with others—these are skills basic to all human learning, problem-solving, and decision-making. Another very important long-term benefit for children who experience the PEACHES curriculum is the awareness that every animal, from a big elephant to a tiny ant, from fluffy ducklings to slimy earthworms, has a special place in nature. This appreciation promotes a reverence for all life, and a caring attitude towards this world that we share with other creatures.

Tree Homes and *Ladybugs* will be the first two PEACHES guides published as part of the GEMS series. They are currently being tested in preschool, kindergarten and first grade sites locally and nationally. Both guides are due out in Spring of 1993. Look for more news about PEACHES in upcoming issues of the GEMS *Network News*.

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"One parent told us that her son immediately put his paper bag penguin puppet in the refrigerator the day he brought it home from school because it needed to live in a cold place!"

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Preschool Explorations for Adults, Children, and Educators in Science:
Penguins and Their Young

Appendix·B

PEACHES Teachers' Guides:

Tree Homes

Homes on the Ground

Ant Homes Under the Ground

Homes in a Pond

Preschool Science and Math Explorations: The PEACHES Handbook for Educators

Los Hogares en los Arboles

Hogares en el Suelo

Hogares Subterráneos

Los Hogares en un Estanque